PATENT SPECIFICATION (11) 1 357 532

1 357 532

(21) Application Nos. 25319/73 (22) Filed 17 July 1970
25320/73 9 Dec. 1970
25321/73 12 Jan. 1971
(61) Divided out of No. 1 357 531
(23) Complete Specification filed 2 July 1971
(44) Complete Specification published 26 June 1974
(51) International Classification B29C 17/04//B29F 1/00
(52) Index at acceptance
B6J 7D1B
B5A 1R20 3D11X 3D2 3DX

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(19)

(54) IMPROVEMENTS IN AND RELATING TO THE ART OF MOULDING

(71) We, AIRFIX INDUSTRIES LIMITED, a British Company, of 17 Old Court Place, London W.8, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with improvements in and relating to the art of moulding.

According to the present invention there is provided a moulding machine comprising first and second mould tools movable in a moulding station relative to one another between an open position and a moulding position, the first mould tool being a cavity tool which when in the moulding station and in the moulding position defines with the other tool a mould cavity having parts corresponding to a peripheral wall and end closure of an open ended container, the cavity tool defining the external surface thereof and the core tool the internal surface, and the cavity tool being movable between the moulding station and a loading station, a foil transfer means comprising a spigot, means to move the spigot relative to the cavity tool when the cavity tool is in the loading station, means to present a foil to the spigot, means to wrap a foil around the periphery of the spigot, and releasable retaining means for holding a foil on the spigot while the spigot is moved relative to the cavity tool to introduce the spigot into the cavity tool, and for releasing the foil therein to allow the spigot to withdraw leaving the foil in the cavity tool for transfer therewith to the moulding station.

Preferably there are two cavity tools of which one is in the moulding station when the other is in the loading station, a foil transfer means being provided for each cavity tool.

According to the present invention there is further provided a method of making a container comprising providing an injection moulding machine with a cavity tool and a core tool, the cavity tool when in closed condition with the core tool defining a moulding cavity a part of which corresponds to a peripheral wall of the container, a part corresponds to an end closure of the container and a part corresponds to a seam for uniting juxtaposed edges of a foil constituting the peripheral wall, alternately positioning the cavity tool in alignment with the core tool and in alignment with a spigot associated with that tool, wrapping a foil around the spigot, holding the foil on the spigot, moving the spigot relative to the associated cavity tool when aligned with that spigot to introduce the spigot into the cavity tool, releasing the foil from the spigot to deposit the foil in the cavity, and relatively moving the spigot and cavity tool to withdraw the spigot from the cavity tool, the foil carrying cavity tool on return to alignment with the core tool being moved relative to the core tool to the closed condition when, with the foil occupying the part corresponding to the peripheral wall, synthetic plastics material is injected into the moulding cavity not occupied by the foil to form a container and withdrawing the container from the moulding cavity.

In order that the present invention may be well understood there will now be described some embodiments thereof, given by way of example only, reference being had to the accompanying drawinge in which:

Figure 1 is a front elevation of a mould cavity tool in an injection moulding machine and diagrammatically shows foil dispensing and transfer means, taken on the line I-I of Figure 2;

Figure 2 is a plan view of part of the moulding machine of Figure 1;

Figure 3 is a diagrammatic section

through a mould tool, mould tool carrier and guide means therefor;

Figure 4 is a cross section through a foil carrier;

Figure 5 is an end elevation of the foil carrier of Figure 4;

Figure 6 is a section through a magazine for foils for use in the machine of Figures 1 and 2;

Figure 7 is a section on the line VII-VII of Figure 6;

Figure 8 is an end view of a second embodiment of foil carrier for use in the machine of Figures 1 and 2, and

Figure 9 is a plan view of the foil carrier of Figure 8.

The injection moulding machine includes a fixed tool carrier 1 and a movable tool carrier 2 guided by guide bars 3 between an open position (Figure 2) and a closed moulding position in which mould tools 4, 5 together define the mould cavities M which will in number equal the impressions to be made upon each mould cycle.

The tool 4 is a double tool movable transversely of the direction of movement of carrier 2 and having parts 6, 7 each of which with the tool 5 will define a set of mould cavities. When one part 6 is in a moulding position (as shown in Figure 1) against fixed tool carrier 1, the other, 7, is in an external position outside the path of movement of that carrier 1 and tool 5. To guide the double tool 4 in its transverse movement there are provided guide rails 8.

Tool 4 is shown as a six impression tool and designed for making tapering thin walled containers such as described in U.K. Patent application No. 23273/70 (Serial No. 1 348 370) each part 6, 7 of the tool 4 defining six cavities 9 and the tool 5 six cores 10.

The foil transfer device comprises a pair of carriages 11 mounted on each of which are six foil carriers 12. Each foil carrier 12 comprises a body 120 having an axis of symmetry 120*a* about which it is rotatable and defining a circumferential surface 120*b* for receiving a foil. In the present embodiment the body 120 is generally frusto-conical corresponding to the shape of a cavity 9 and the container to be made therein. Each of the carriers 12 is coaxial with a cavity 9 of one part 6 or 7 of tool 4 when in the external position relative to the path of tool 5. Each carrier body 120 is rotatable about its axis on sealed bearing races 121 carried by a support 122 having passages 123, 124 coupled to a vacuum source, not shown. Passage 123 is coupled to a manifold 125 and thence to a first set of ports 126 in the carrier body surface 120*b*, while passage 124 is coupled to manifold 127 in turn coupled to a plurality of second sets of ports 128 in the carrier body surface 120*b*. 'O' rings 129 seal the manifolds. A drive such as a motor 14 is mounted on each carriage and is coupled to the carriers on that carriage by a gear train (not shown) for which purpose each carrier has teeth 130. Other forms of drive such as a chain or rack and pinion could be used.

In a plane tangential to the surface of each carrier is the surface of a guide element 15 on which slides a vacuum plate 16, coupled to the vacuum source and movable by an arm 17 pivoted at 18 on a support structure. A drive to the arm of any convenient kind is operable to swing the plate 16 from a position over a foil magazine 19 to a position in which the leading edge of a foil held by the plate 16 lies over ports 126 of the associated carrier. Application of vacuum at the ports 126, if necessary use of jets of air directed on to the leading edge of the foil and release of vacuum at the plate causes a foil carried by the plate to be attached to the carrier. Rotation of the carrier and application of vacuum to the ports 128 will then wrap the foil around, and hold it on to, the carrier. Advance of the respective carriage 11 in the direction of the carrier axes will move the carriers into the axially aligned idle cavities 9 and release of vacuum at the ports 126, 128 will release the foils from the carriers, each foil springing open under its own resilience off the respective carrier and on to the internal surface of the respective cavity. The carriage is then retracted. The loading, advance, unload- and retraction of the carriage and carriers occurs while the moulding cycle is effected. Upon completion of that cycle, tool 5 is retracted and the tool 4 is moved transversely to displace the empty cavities to their external position out of the path of the movable tool 5 for loading with foils and the loaded cavities into moulding position in the path of tool 5 for a moulding cycle. Drive to the carriages and to the tools may be by piston/cylinder assemblies or rack and pinion drives.

Each magazine 19 is preferably particularly adapted to ensure that a single foil only is picked up by the respective plate 16. As shown in Figures 6 and 7, each magazine 19 comprises a lower fixed portion 202, an upper portion 203, telescopically movable relative to portion 202, and a foil back-up member 204. The member 204 is movable by a piston and cylinder arrangement (not shown) within the magazine 19 to hold and bias a stack of foils 205 in the magazine against foil edge retaining lips 206 carried on the magazine portion 203.

The upper magazine portion 203 is guided

in its movement relative to portion 202 by fingers 207 fixed in recesses in the portion 202 and extending into recesses in the portion 203. These fingers 207 also prevent foils in the magazine from moving into the gap between the two magazine portions 202, 203. The magazine portion 203 is biased for movement away from portion 202 by springs 208 located in bores 209 in the portions and is moved towards the portion 202 into abutting relation therewith by piston and cylinder means (not shown).

Foils are removed individually from the magazine by the vacuum plate 16. The plate 16 is movable about pivot 18 from a foil receiving station above the magazine to adjacent the foil carrier by a piston and cylinder arrangement (not shown) acting on arm 17 and, at the foil receiving station to and from a foil pick-up position, as shown in the Figures, by a piston and cylinder arrangement 211. The plate 16 is pivotally mounted on arm 17 and the piston and cylinder 211 is mounted between plate 16 and arm 17 for relative pivotal movement.

In operation, with the plate 16 in the foil receiving station, the magazine portion 203 held in its abutting position relative to portion 202 by its piston and cylinder and the foils biased by back-up member 204 against the lips 206, the piston and cylinder 211 is operated to pivot the plate 16 down into the foil pick-up position. Suction is applied to the plate which thereby engages the uppermost foil in the magazine, Figure 6. Thereafter, the upper portion 203 of the magazine is moved upwards. under the bias of the springs 208, so that the foils in the magazine are released from the compressive force exerted on them by the lips 206.

Finally, as the plate 16 is pivoted back to its original position by the piston and cylinder arrangement 211, the upper magazine portion 203 is moved by its piston and cylinder means (not shown), against the bias of springs 208, back into abutting relation with the portion 202.

During these final two movements, the foil engaged by the plate 16 is drawn past the lips 206 and in being so drawn is slightly bowed downwardly by the presence of the lips. This bowing causes any additional foil carried therewith to break free of the engaged foil so that such a foil is retained in the magazine by the lips 206. This bowing is effective because of the removal of the compressive force on the stack of foils by the upward movement of the magazine portion 203.

Thereafter the plate 16 and foil are moved to the respective foil carrier at which vacuum is removed from the plate 16 to allow the sheet to be disengaged therefrom.

Although the above described magazine and vacuum plate are controlled by cylinders and pistons to which compressed air or other fluid is supplied, the control may alternatively be electric.

In the above described apparatus the magazine 19 is shown and described as being vertically orientated; the magazines for the various foil carriers may have a varying inclination to the vertical as shown in Figure 1.

Any suitable controls may be used to ensure the proper sequence and distance of movements and of application and release of vacuum and operation of air jets if provided.

The configuration of the carrier body may be varied as required in dependence on the shape of the mould cavity and the article to be produced therein. For example, the carrier body may be cylindrical or frusto-conical, as above described, or may have an oval or polygonal or part rectilinear part arcuate cross- section as described.

A tapering square section carrier is shown in Figures 8 and 9 for use with correspondingly shaped mould tools. Carriers 312 replace the carriers 12 of the above described embodiment with corresponding replacement of the tools 4, 5.

The carrier 312 includes a body 320 having a generally square section and is rotatable about its axis of symmetry 320*a* in a manner similar to the above described carrier 12. The circumferential surface 320*b* of the carrier is provided with a plurality of ports 326, 328 connected to a source of vacuum.

As in the above described embodiment a foil 205 is fed tangentially in the direction of the arrow to that planar portion of surface 320*b* of the carrier body provided with ports 326. When the foil is positioned by the vacuum plate 16 over the ports 326, with its leading edge immediately above the furthest corner 337 of the surface portion, the vacuum on the plate 16 is released, the vacuum source is connected to the ports 326 and 328 successively and the carrier rotated so that the foil is drawn down and held on to the surface of the carrier as in the above described embodiment.

Thereafter as described in the above embodiment the carrier is moved axially into a cavity having corresponding dimensions.

To assist and ensure correct wrapping of the foil around the carrier body surface, one or more leaf springs 338 may be provided above the uppermost surface portion of the carrier body and biased into contact with that surface portion. In operation, the

leaf spring 338 is moved from its operative position by the vacuum plate 16 as it brings a foil to the carrier but moves back into position on withdrawal thereof. It is also moved out of the path of the carrier when the carrier moves axially into the cavity.

In a modification the leaf spring 338 may be replaced by a freely rotatable roller spring biased down on to the surface of the carrier body.

The apparatus is capable of high production rate due to the low downtime between moulding injections.

The foil constitutes the peripheral wall portion of the receptacle as described in co-pending application No. 23273/70. (Serial No. 1 348 370).

In addition to using the carriers to apply foil to the peripheral wall of a cavity they may be used to carry a foil on the end thereof, applied thereto by another carrier or by a second swinging arm and vacuum plate. In that case means may be required to blow the foil off the carrier into the cavity and it may be desirable to apply a static charge to the foil to hold it in the cavity.

Whilst a machine has been described in which the fixed tool is changed between each moulding cycle for loading purposes, it is also possible to change that tool which is normally the moving tool.

Although as described a foil is fed to a foil carrier from a magazine by a suction plate, the machine may be modified so that each magazine is located relative to its carrier to position the next foil to be withdrawn tangentially of the surface of the carrier, application of vacuum to the carrier ports causing that foil to be picked up by the carrier and rotation of the carrier causing the foil to be withdrawn from the magazine and simultaneously wrapped round the carrier.

The term foil as used herein is intended to mean a piece of any flexible sheet material, as for example, synthetic plastics or metal foil, paper, board or any flexible laminated or coated sheet material whether pervious or impervious to fluids. The material may be plain or printed and of variable opacity as required.

Attention is directed to our co-pending application No. 34926/70 from which the present application was divided. (Serial No. 1 357 531).

WHAT WE CLAIM IS:—

1. A moulding machine comprising first and second mould tools movable in a moulding station relative to one another between an open position and a moulding position, the first mould tool being a cavity tool which when in the moulding station and in the moulding position defines with the other tool a mould cavity having parts corresponding to a peripheral wall and end closure of an open-ended container, the cavity tool defining the external surface thereof and the core tool the internal surface, and the cavity tool being movable between the moulding station and a loading station, a foil transfer means comprising a spigot, means to move the spigot relative to the cavity tool when the cavity tool is in the loading station, means to present a foil to the spigot, means to wrap a foil around the periphery of the spigot, and releasable retaining means for holding a foil on the spigot while the spigot is moved relative to the cavity tool to introduce the spigot into the cavity tool, and for releasing the foil therein to allow the spigot to withdraw leaving the foil in the cavity tool for transfer therewith to the moulding station.

2. A moulding machine according to claim 1 including two cavity tools of which one is in the moulding station when the other is in its loading station, a foil transfer means being provided for each cavity tool.

3. A moulding machine according to any of the preceding claims in which the or each cavity tool is movable along a path normal to the path of the second mould tool which is movable toward and away from the cavity tool path.

4. A moulding machine according to any of the preceding claims in which the spigot is movable parallel to the direction of relative movement of the first and second tools in their relative movement to and from the moulding position.

5. A moulding machine according to any of the preceding claims in which the or each spigot is rotatable and the means to present a foil to the spigot will in operation position a foil tangentially to the spigot so that the foil is progressively applied to the spigot by rotation of the spigot.

6. A moulding machine according to claim 5 comprising a magazine for receiving a stack of foils, the means to present a foil to a spigot including a foil pick-up member for picking up a foil from the magazine and presenting the foil to the spigot tangentially of the surface thereof.

7. A moulding machine according to claim 6 wherein said foil pick-up member is pivotally mounted for movement between the magazine and spigot in a plane tangential to the surface of the spigot.

8. A moulding machine according to any of the preceding claims in which the or each cavity tool defines a frusto-conial cavity and the or each spigot is frusto-conical.

9. A mechanism as claimed in any of claims 1 to 8 wherein the or each spigot

has a polygonal cross-section transverse to its axis and is tapered.

10. A method of making a container comprising providing a moulding machine with a cavity tool and a core tool, the cavity tool when in closed condition with the core tool defining a moulding cavity a part of which corresponds to a peripheral wall of the container, a part corresponds to an end closure of the container and a part corresponds to a seam for uniting juxtaposed edges of foil constituting the peripheral wall, alternately positioning the cavity tool in alignment with the core tool and in alignment with a spigot associated with that tool, wrapping a foil around the spigot, holding the foil on the spigot, moving the spigot relative to the associated cavity tool when aligned with that spigot to introduce the spigot into the cavity tool, releasing the foil from the spigot to deposit the foil in the cavity, and relatively moving the spigot and cavity tool to withdraw the spigot from the cavity tool, the foil carrying cavity tool on return to alignment with the core tool being moved relative to the core tool to the closed condition when, with the foil occupying the part corresponding to the peripheral wall, synthetic plastics material is injected into the moulding cavity not occupied by the foil to form a container and withdrawing the container from the moulding cavity.

11. A moulding machine substantially as hereinbefore described with reference to the accompanying drawings.

12. A method of making a container substantially as hereinbefore described.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1974
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1,357,532 COMPLETE SPECIFICATION
5 SHEETS

This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

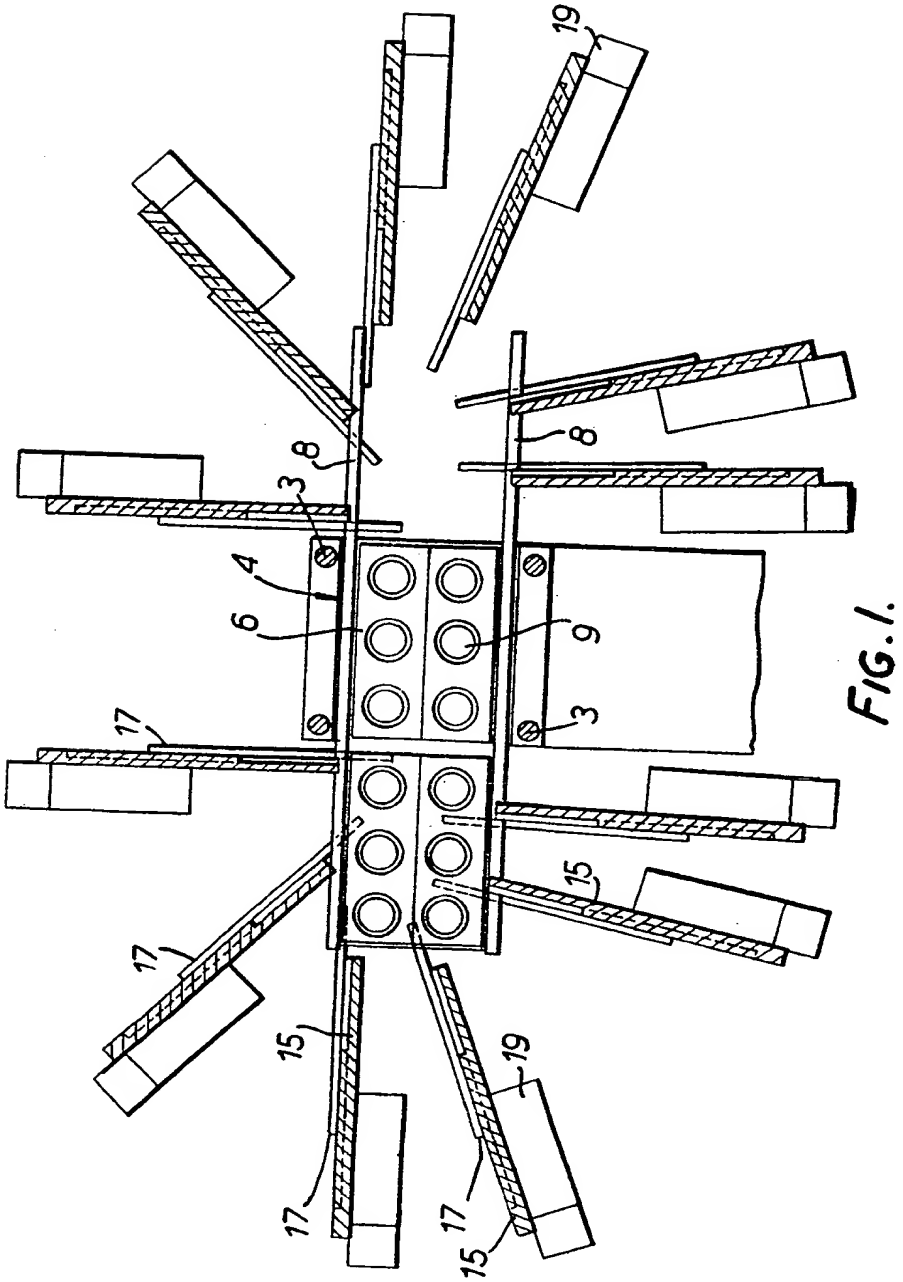

FIG. 1.

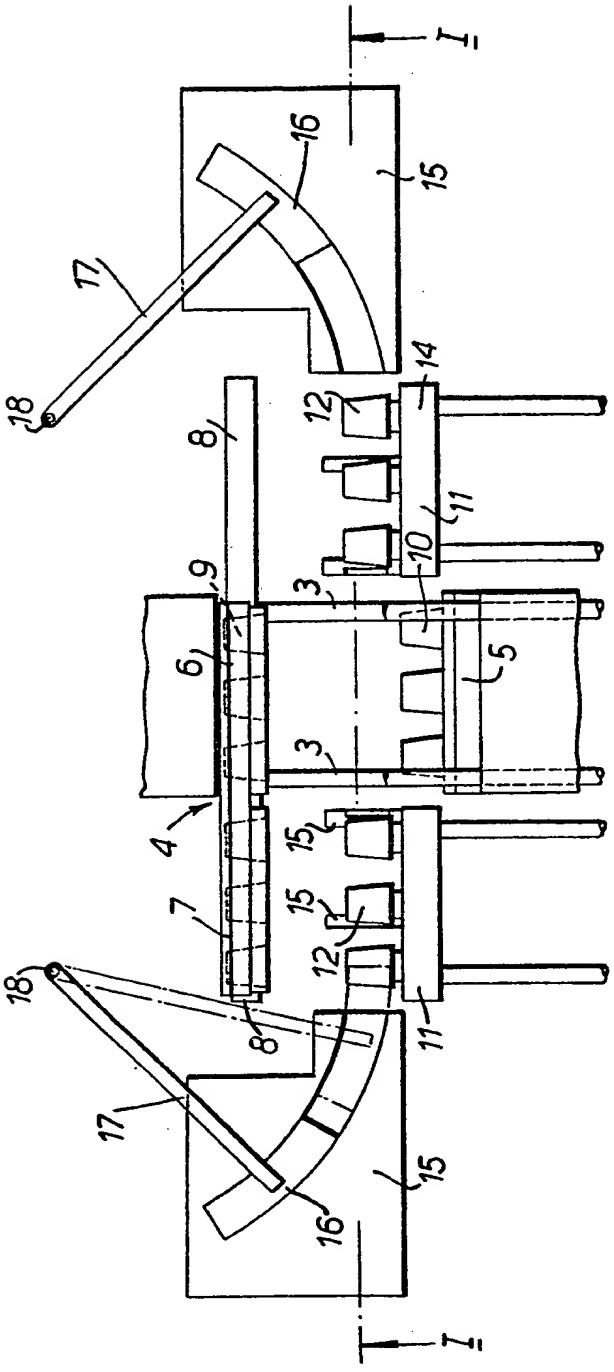

FIG.2.

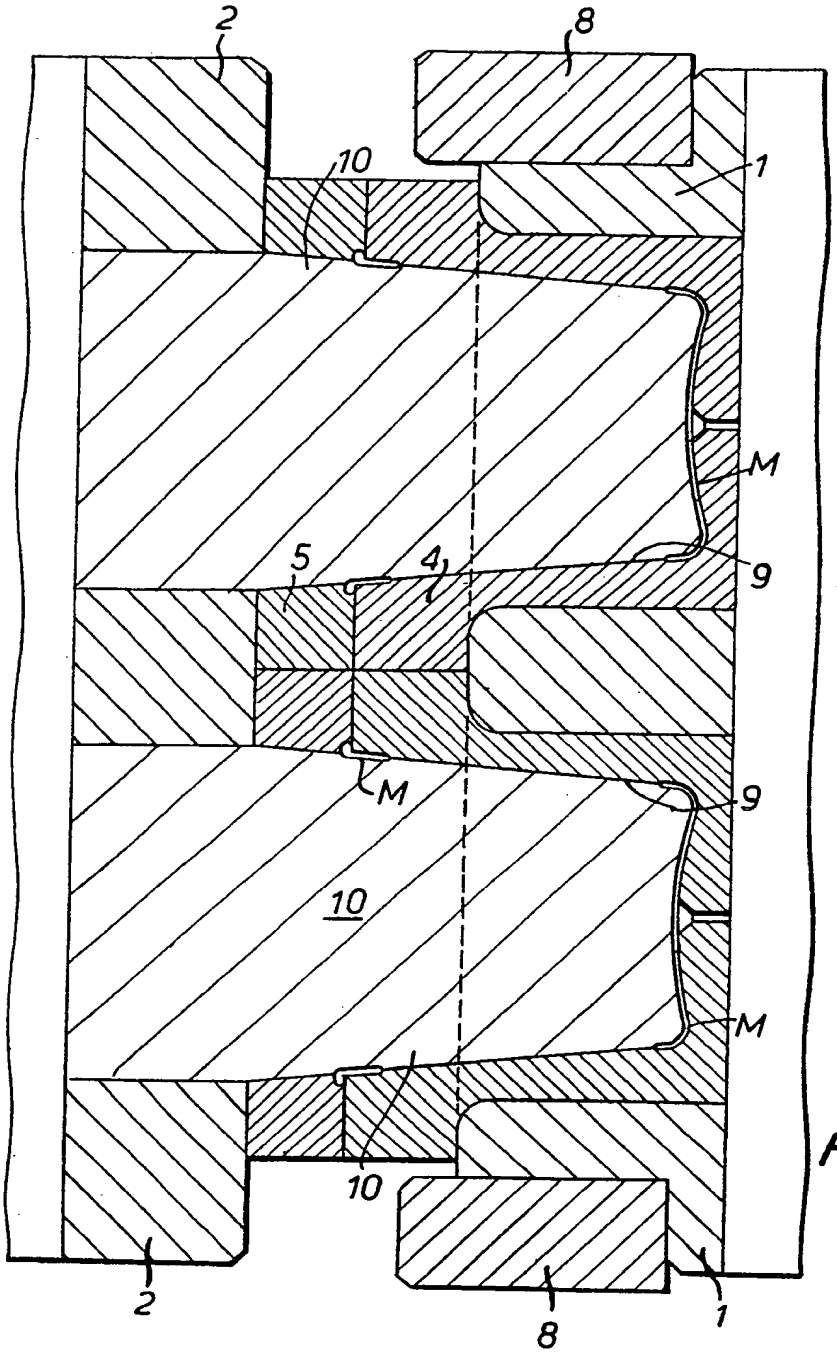

FIG. 3.

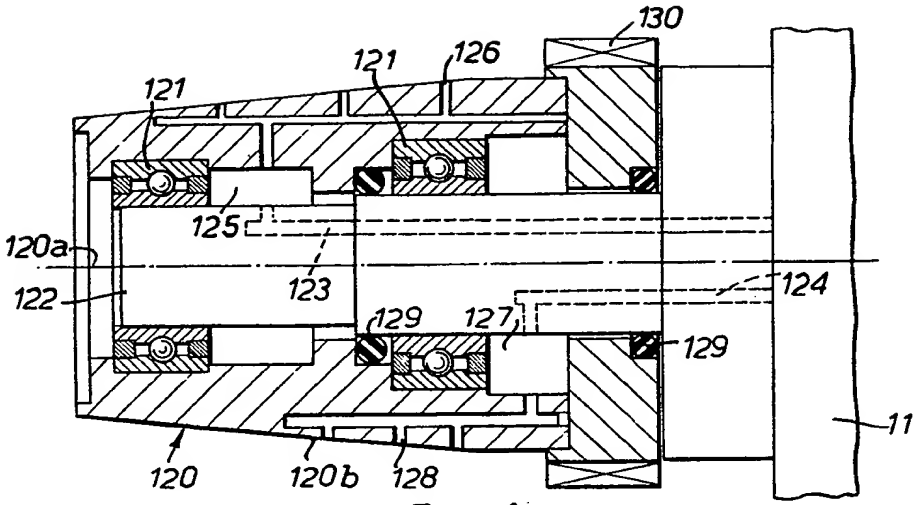
130
121
126
121
125
120a
122
123
124
129
127
129
11
120
120b
128

FIG. 4.

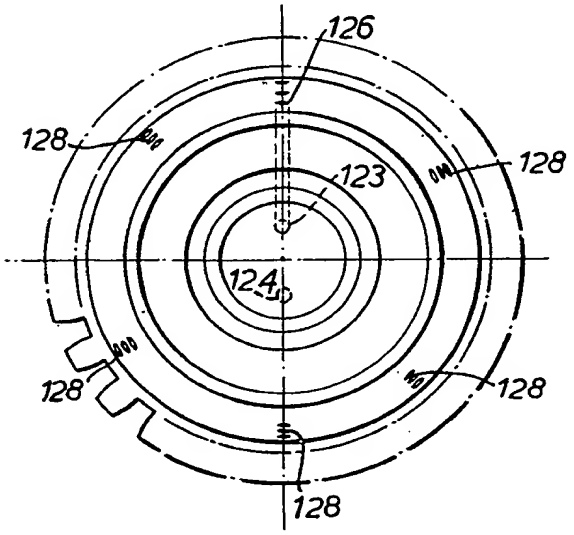
126
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FIG. 5.

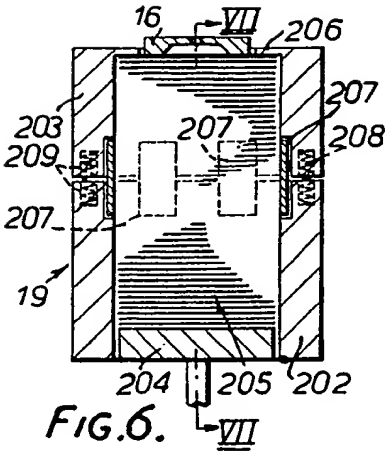

FIG.6.

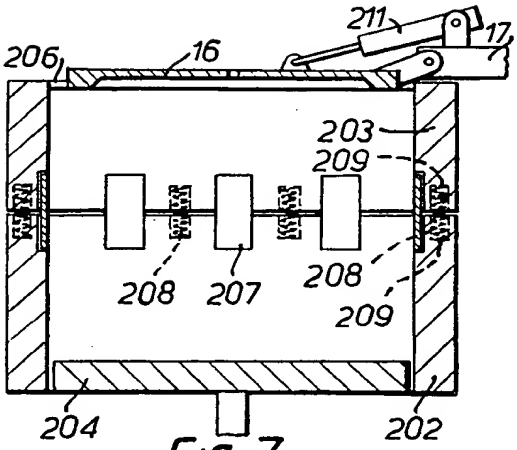

FIG.7.

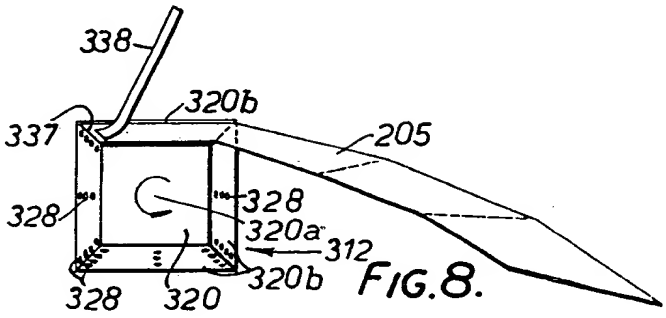

FIG.8.

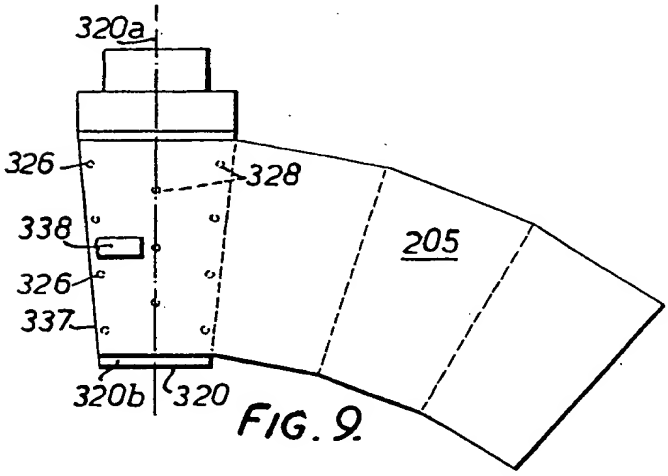

FIG.9.